Knowledge of good nutrition, physical activity and sleeping habits in pre-schoolers

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Summary
Children's knowledge about food and nutrition is very important for the development of appropriate patterns of eating behaviour. Nowadays, because children's input is becoming to get more importance in parents' decisions about nutritional choices it is important to contribute for their knowledge development regarding not only nutrition or food but also healthy habits regarding sleeping and physical activities.

The purpose of this study was to contribute for the assessment of nutrition/food preferences in pre-schoolers and the contribution of gaming for nutrition/food knowledge evaluation. It also intended to establish a relation between children's BMI and the knowledge of nutrition/food and good sleep and physical activities habits.

An observational, cross-sectional, quantitative study was conducted with 364 children's attending preschool from a metropolitan area of the norther region of Portugal and their parents.

Food preferences varied from pasta (13.4%) to meat (8.8%) or tomatoes (6.3%) and undesired foods were, among others, fish (16.2%), soup (13.2%), tomatoes (12.6%) and onions (10.7%). Preschoolers showed high levels of knowledge regarding food categorization (92.3%), good sleeping habits (90.1%) and good physical activities habits (94.0%).

Results showed significant differences for sleeping habits knowledge with lower BMI (kg/m^2) for children that gave correct answers (M = 16.35, SD = 2.04 vs. M = 17.62, SD = 2.37). Children with increased BMI showed more risk of poor knowledge regarding good sleeping habits (aOR = 1.33, 95% CI = [1.07-1.69]). Parent's low education was found to be a risk factor for children's poor knowledge of good sleeping habits (OR = 8.21, 95% CI = [1.85-35.55]).

KEYWORDS: FOOD; NUTRITION; PHYSICAL ACTIVITIES; SLEEP; BMI.

Introduction

Children's knowledge about food and nutrition is very important for the development of eating patterns and behaviours[1]. Most of the patterns are built on parents' verbal and non-verbal communication with their children regarding food. Children's also participate and interact in the pattern construction, by their behaviour towards food, namely when new foods are introduced in their diet[1-2].

Eating habits have been changing over the time in Europe. In the early 1900's malnutrition was an important concern among children. Nowadays the problem has shifted to excessive exposure to nutritionally low or unbalanced foods with high calorie with poor nutrient contributions[3-4]. The increased prevalence in childhood obesity in developed countries has catalysed the debate about the introduction of dietary and nutrition subjects into schools programmes. Moreover sleeping and physical activities habits can play a key role on diminishing obesity[5].

It has been a growing tendency for children to fail on meeting the minimum recommended quantities of what can be considered as healthy food[6]. Children are highly dependent on parents' perception about what are and what healthy foods aren't, and parent's knowledge of healthy food does not always correspond to a real healthy food definition[3]. Social context is also an

important determinant regarding food choice, but now more than ever preschoolers are gaining some degree of control regarding their food choices[7]; children that spend more time watching television tend to be more exposed to advertisements regarding energy-dense foods and few or none fruits and vegetables and at the same time engage in less physical activities[8-9]. The time spent in screen-type activities also correlated with poor sleeping habits[9].

Children's preferences towards food and how these preferences are internalized are important for a better understanding of attitudes towards food and thus to the development of strategies applied to health education programs[10-11].

Health education programmes can be an effective way of improving parents' and educators' skills related to children's behaviours towards food[10-12]. Nevertheless according to Pyo and Kang (2014) programs directed to nutritional education can be effective even when directed to preschoolers, especially in the range of 4-6 years old[13].

Holub and Musher-Eizenman (2010) stated that children with at least 3 years old are capable to distinguish healthy form unhealthy food[14]. In the same way Nguyen and Murphy (2003) pointed that children with 4 years old are able to categorize foods into healthy or unhealthy categories[15].

Some researchers have pointed out that, due to the number of hours spent in school, this environment offers a changing opportunity, if provided the necessary resources for the implementation of nutrition education programmes[16-17].

This study main goals were:

1) To assess the nutrition/food preferences in preschoolers and the contribution of gaming for nutrition/food knowledge evaluation.

2) To relate the knowledge of food/nutrition, sleep and physical activities habits of pre-schoolers with their BMI.

Research questions

What are the nutrition/food preferences of preschoolers?

Can oriented-nutrition/food games contribute for nutrition/food knowledge evaluation?

Is there a relation between nutrition/food knowledge, sleep and physical activity habits and children's BMI?

Purpose of the study

This study attempts to contribute for determining the level of knowledge regarding nutrition and food in preschoolers and assess the contribution of a game for nutrition/food knowledge evaluation in a sample of children attending preschool from a metropolitan area of Oporto city in Portugal.

Accordingly, the following objectives were delineated:

- Characterize the sample studied by biographical data collection.
- Characterize the nutrition/food preferences in preschoolers.
- Contribute for understanding of the importance of oriented nutrition/food games for nutrition/food knowledge evaluation.
- Contribute for assessing the relation between nutrition/food knowledge, sleep and physical activity knowledge of good habits and children's BMI.

Research methods

Observational, cross-sectional and quantitative study with a population composed by children attending preschool. Data was collected from September 2016 to February 2017 by used of a questionnaire and consisted in a non-probabilistic sample of 364 children's and their parents regarding 22 classes of six different school establishments from the metropolitan area of Oporto city in Portugal. Inclusion criteria were children attending preschool without special educational needs, that participated in the anthropometric assessment and whose parents agreed to participate in the study by signing informed consent.

Instrument and procedures

Instrument was a questionnaire, adapted from the original study of Sancho (2014) and addressed sociodemographics, anthropometric data and knowledge of nutrition/food, sleep and physical activity habits[18]. The study and questionnaire were approved by the ethical committee of Instituto de Ciências Biomédicas Abel Salazar (ICBAS). After approval, a total of 22 meetings (one per class) occurred in the presence of parents/tutors and the kindergarten teacher. After explaining the study, the parents that agreed to participate signed the informed consent and received an open envelop with the questionnaire. Afterwards, filled questionnaires were delivered to the kindergarten teacher or the researcher. Moreover, in this study a gaming strategy was used to assess the contribution of oriented nutrition/food games for nutrition/food knowledge evaluation in preschoolers. For that purpose a game was implemented in each class using different types of food printed in magnet cards. Children were asked to place each magnet card in the correct place of the Portuguese food wheel. The same type of activity was performed regarding sleep and physical activity; children were encouraged to place magnets regarding good sleeping and physical activities habits.

Statistical analysis

SPSS (version 24)[19] was used to perform statistical analysis. Descriptive statistics were presented as means (*M*) and standard deviations (*SD*) for quantitative variables, medians (Mdn) and interquartile ranges (IQR) for ordinal variables and fre-

quencies (*n*) and percentages (%) for categorical variables. Percentages were adjusted for missing values always totalizing 100%. Missing values were discharged separately for each analysis. T-tests (for continuous variables) and Mann-Whitney tests (for ordinal variables) were used to assess differences between children that gave correct answers vs. children whose answers were incorrect. Normality was assessed with Kolmogorov-Smirnov test.

Crude and adjusted odds ratios (OR/ aOR) were calculated via logistic regressions for determining the risk of correct/incorrect answers regarding significant variables previously screened by t-tests or chi-square/fisher tests. Statistical significance was based on the analysis of the 95% confidence interval (CI) for the OR. Significance was considered if 1 was not included in the CI.

Sample

We assessed a total of 364 children, from 2.75 to 6.67 years of age (M = 4.48, SD = 0.91). Birthweight ranged from 1.32 kg to 4.15 kg (M = 3.16, SD = 0.50) and current BMI score ranged from 1 to 5 (Mdn = 2.0, IQR = 1). Regarding family status, 314 (86.4%) were from nuclear families with/ without brothers, 32 (8.8%) from monoparental families and 18 (4.9%) from families in which the mother or father lived with other elements (e.g. partners, uncle/ aunt, grandparents). Mother's age ranged from 19 to 51 years old (M = 34.51, SD = 5.43) and father's age ranged from 22 to 56 years old (M = 36.94, SD = 5.73). Questionnaire respondents were in the vast majority mothers (n = 320, 87.9%).

PRESCHOOLERS NUTRITION/FOOD PREFERENCES **1**

Type of preferred food	*n (%)*	Type of undesired food	*n (%)*
Pasta	49 (13.4%)	Fish	59 (16.2%)
Meat	32 (8.8%)	Soup	48 (13.2%)
Tomatoes	23 (6.3%)	Tomatoes	46 (12.6%)
Lettuce	23 (6.3%)	Onions	39 (10.7%)
Rice	18 (4.4%)	Milk	35 (9.6%)
Fruit	18 (4.4%)	Meat	31 (8.5%)
Potatoes	15 (4.1%)	Salad	25 (6.8%)

PRESCHOOLERS NUTRITION/FOOD, SLEEPING AND PHYSICAL ACTIVITIES GOOD HABITS KNOWLEDGE **2**

Correct responses	n (%)
Nutrition/Food	337 (92.3%)
Sleeping	329 (90.1%)
Physical activities	343 (94.0%)

BMI COMPARISON REGARDING NUTRITION, SLEEPING AND PHYSICAL ACTIVITIES GOOD HABITS KNOWLEDGE **3**

	BMI (kg/m²)			BMI (WHO Z-score categories) [1-5]		
Knowledge	Correct answer	Incorrect answer	p-value (t-test)	Correct answer	Incorrect answer	p-value (MW-test)
Nutrition/ food	16.41 (2.08)	16.67 (2.02)	p = .704	2.0 (1.0)	2.0 (1.0)	p = .958
Sleeping	16.35 (2.04)	17.62 (2.37)	p = .012*	2.0 (1.0)	2.5 (2)	p = .050
Physical activities	16.42 (2.09)	16.79 (2.00)	p = .418	2.0 (1.0)	2.0 (1.0)	p = .521

NOTE: * p < .05; BMI (kg/m2) results presented as M (DP); BMI (WHO Z-score) presented as Mdn (IQR)

Findings

Variables description

The favourite types of food referenced by children were pasta (13.4%), meat (8.8%), apples (8.8%), tomatoes (6.3%) and lettuce (6.3%). On the other hand, among the most undesired types of food, children selected fish (16.2%), soup (13.2%), tomatoes (12.6%), onions (10.7%), milk (9.6%), meat (8.5%) and salad (6.8%) (table 1).

Preschoolers showed high levels of knowledge regarding food categorization (92.3%), good sleeping habits (90.1%) and good physical activities habits (94.0%) (table 2).

Variables association

BMI (kg/m²) and BMI (WHO Z-score) were compared with nutrition/ food, sleeping and physical activities good habits knowledge (correct vs. incorrect answers). BMI (kg/m²) was calculated according to the standard formula (weight/height²). BMI (WHO Z-score) were based on WHO recommendations (Onis & Lobstein, 2010) for five progressive intervals based on standardized BMI scores. Table 3 showed significant differences for sleeping habits knowledge with lower BMI (kg/m²) for children that gave correct answers (M = 16.35, SD = 2.04 vs. M = 17.62, SD = 2.37).

The association of BMI (Kg/m²) with the knowledge of good sleeping habits was performed by means of logistic regressions. Crude OR showed higher risk of incorrect answers for children with increased BMI (Kg/ m²) (OR=1.26, 95% CI=[1.05-1.52]).

CRUDE AND AOR FOR SLEEP KNOWLEDGE (CORRECT/INCORRECT ANSWER) RELATION WITH BMI (KG/M²) 4

Sleep knowledge (risk for incorrect answer)	BMI (kg/m²) OR (95% CI)
OR	1.26 (1.05-1.52)*
aOR	1.33 (1.07-1.69)*

NOTE: * significant result

CRUDE AND AOR FOR SLEEP KNOWLEDGE (CORRECT/INCORRECT ANSWER) RELATION WITH PARENTS EDUCATION 5

Education[a]	OR (95% CI)	aOR (95% CI)
Low	8.21 (1.85-35.55)*	4.95 (0.88-27.97)
Medium	1.36 (0.41-4.50)	1.06 (0.30-3.75)
High	1	1

NOTES: [a] maximum level among father and/or mother; *significant result.

Adjusted OR (aOR) were calculated considering the confounders gender, birth weight, mothers' BMI, pregnancy time and parents highest degree of education. Again, children with increased BMI showed more risk of poor knowledge regarding good sleeping habits (aOR=1.33, 95% CI=[1.07-1.69]) (table 4).

Next, we analysed the association of nutrition/food, sleeping and physical activities good habits knowledge (correct vs. incorrect answers) with parent's education level. We considered basic education as any degree bellow the 9th grade, medium education as degrees between the 9th and 12th grade and high education as university degrees. Overall, parent's education levels ranged from basic to high education. No illiterate parents were found. We considered the highest grade among parents as the aggregate level of education

Chi-square significant differences were found when associating parents' highest education degree with the knowledge of good sleeping habits (p = .008), but not with nutrition/food (p = .173) or physical activities (p = .763). Hence logistic regressions considered only the association between knowledge of good sleeping habits and parents education. Adjusted OR (aOR) were calculated considering the confounders gender, birth weight, mothers' BMI, children's' BMI and pregnancy time. Children's whose parents were low educated showed increased risk of incorrect answers regarding knowledge of good sleeping habits (OR = 8.21, 95% CI = [1.85-35.55]). Significance was lost when adjusting for confounders (aOR = 4.95, 95% CI = [0.88-27.97]) (table 5).

Finally, no significant differences were found when association children's responses regarding good sleeping habits and parents response related with their children sleeping habits (p = .744).

Discussion

This study aimed to contribute for determining the level of knowledge regarding nutrition and food in preschoolers and assess the contribution of a game for nutrition/food knowledge evaluation in a sample of children attending preschool from a metropolitan area of Oporto city in Portugal. Moreover its scope was also to bring some contribution for the study of the relation of BMI and with knowledge regarding nutrition/food and god habits of sleep and physical activity.

In our sample food preferences varied from carbon hydrates such as pasta to protein (meat), fruit (apple or tomatoes) and vegetables (lettuce). On the other hand, fish was the most undesirable type of food, followed by soup, tomatoes and onions. These results have some respawn with similar studies[4,12]. In our sample of pre-schoolers there was evidence of high levels of knowledge regarding nutrition/food categorization, but also good sleeping and physical activity habits. Our results are corroborated by other studies like Dias et al. (2016) study, in which children aged 4-6 years old were able to learn and choose in favour of healthy foods[10]. These authors found an important percentage of children aged 4-6 that included fruit and vegetables as their favourite types of food. Similar results were found by Tatlow-Golden et al. (2013) whose conclusions advocate in favour of meaningfully identification of healthy foods by pre-schoolers[4]. Also in the study of Holub and Musher-Eizenman (2010) children with at least 3 years old were capable of "createing" healthy and unhealthy meals in which healthy meals had, in average, significantly less fat and more fruit and vegetables, compared to unhealthy meals[14]. In the study of Nguyen and Murphy (2003) that assessed nutrition knowledge of children with 4 years old results showed significant proportion of correct answers when categorizing foods into healthy or unhealthy categories[15].

In our study we found an important relation between knowledge of good sleeping habits and BMI. Children with increased BMI showed more risk of poor knowledge regarding good sleeping habits. These results are corroborated by other studies like Cappuccio et al. (2008)[20] and Van Cauter & Knutson (2008)[21].

We didn't found a relation between nutrition/food knowledge and BMI, contradicting studies like Pyo and Kang (2014)[13] and Grosso et al. (2012)[8] that described a relation between BMI and nutritional knowledge. Peters et al. (2014) found decreased BMI scores in children with healthier habits, compared with other children[6]. In Portugal Durão et al. (2014) as also found a relation between preferences and

consumption for energy-dense foods with increased BMI[22].

Finally we found a relation between parents' low education and children's poor knowledge regarding good sleeping habits. This result as respawn in the studies of Cappuccio et al. (2008)[19] and Van Cauter & Knutson (2008)[20] that also established a relation between parent's education and children's sleeping habits. Other studies point out the existence of a relation between socioeconomic and education status and the ability do understand the concepts of nutrition/food (Tatlow-Golden et al., 2013), what can be considered as adjacent to educational level[4].

Conclusion

This study goals were to contribute for determining the level of knowledge regarding nutrition and food in pre-schoolers and the importance of educational strategies, such as gaming, for evaluation nutrition/food knowledge. It also intended to add some contributions to the study of the relation between nutrition/food knowledge and BMI and also of sleep and physical activity knowledge of good habits and BMI.

Food preferences were mainly carbon hydrates (pasta), protein (meat) and also some fruits and vegetables. The most undesirable type of food was fish, followed by soup, tomatoes and onions. Curiously tomatoes were simultaneously selected as one of the favourite types of food. Regardless of the food preferences, most children were able to categorize correctly different types of food, after engaging a magnet game designed to promote knowledge, revealing good nutrition/food knowledge. These results were extended to knowledge regarding good habits of sleeping and physical activity.

In this study we found and association between knowledge of good habits of sleeping and BMI. Preschoolers with higher scores of BMI showed less knowledge of good sleeping habits, even in the presence of confounder variables. Children's poor knowledge regarding good sleeping habits was also associated with parents' low education. On the other hand no association was found between knowledge of nutrition/food or knowledge of good habits of physical activity and BMI or parents' education. Based on these results future intervention programs can focus not only in nutrition/food knowledge but also in sleeping habits, since they can be related with higher scores of BMI. Nursing practices could also include more interventions regarding not only the importance of food and nutrition, but also information related to sleeping habits, since they were shown to be related with BMI.

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